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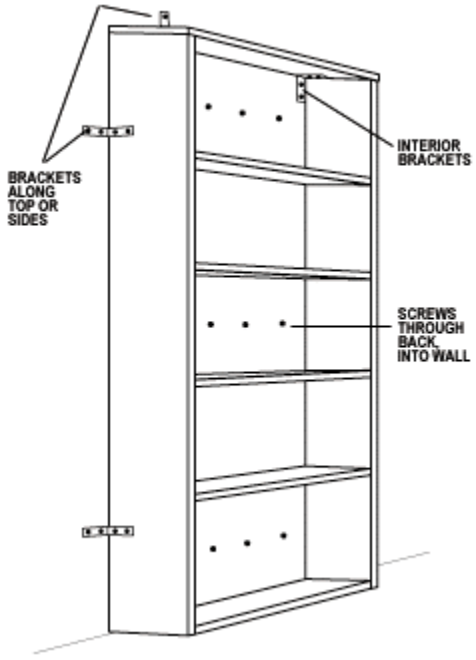
Protecting Your Property from Earthquakes



Anchor Tall Bookcases and File Cabinets

Are You at Risk?

If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earthquake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is anchoring large pieces of furniture, such as bookcases and file cabinets, so that they will remain upright during an earthquake. This is something that many homeowners can probably do on their own.

Anchor Tall Bookcases and File Cabinets

During an earthquake, large pieces of furniture such as tall bookcases and file cabinets can fall on you or members of your family. Toppled furniture can also block exits and prevent you from escaping. Anchoring furniture so that it remains upright not only helps prevent injuries but also helps protect both the furniture and its contents.

You can anchor large pieces of furniture in several ways. The figure shows how to anchor a bookcase to a wall, but the same methods can be used for other pieces of furniture. As shown in the figure, a bookcase can be anchored with metal L brackets and screws along its top or sides (either inside or outside) or with screws through its back.

Tips

Keep these points in mind when you anchor large pieces of furniture:

- Make sure that all anchoring screws penetrate not just the wall but the studs behind it as well. Screws embedded only in drywall or plaster will pull out. Regardless of the anchoring method you use, the screws should be long enough to extend at least 2 inches into the wall and studs.

- Before anchoring a bookcase with screws through its back, make sure the back is sturdy enough and that it is securely attached to the sides, top, and bottom. Some bookcases have backs made of very thin materials that are held in place with only small screws or staples that can easily pull out. Those bookcases should be anchored with brackets.

- If you have two or more bookcases or file cabinets that sit next to each other, consider connecting them to one another as well as to the wall. They will be even more stable if you do.

- If possible, move all bookcases, file cabinets, and other large pieces of furniture away from exits so that if they do fall, they won't prevent you from escaping.

- To prevent the contents of your bookcases from falling out, you can install a thin metal or plastic rod, a wood dowel, or even an elastic band across the front of each shelf.

Estimated Cost

The cost of anchoring a bookcase or file cabinet will depend on its width. In general, if you do the work yourself, you can expect the cost to be approximately $5 per foot. So, for example, anchoring a 3-foot-wide bookcase will cost you about $15. This amount covers only the hardware you will have to buy and excludes the cost of any tools you use and the value of your time. If you hire a contractor or handyman to do the work, you will have to pay for time as well as materials.

Other Sources of Information

Seismic Retrofit Training for Building Contractors and Building Inspectors: Participant Handbook, FEMA, 1995.
Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, FEMA-74, 1994.
Protecting Your Home and Business from Nonstructural Earthquake Damage, FEMA, 1994.
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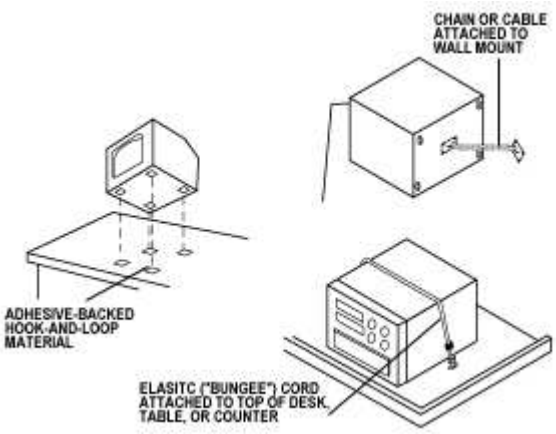
Protecting Your Property from Earthquakes

Desktop Computers and Appliances

Are You at Risk?



If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earthquake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But compli-cated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is restraining personal computers and other small desktop appliances. This is something that many homeowners can probably do on their own.

Restrain Desktop Computers and Appliances

The tremors caused by even minor earthquakes can easily move personal computer systems, stereo systems, television sets, and other small appliances that typically sit on desks, tables, and countertops. If they fall, they can be damaged beyond repair.

As shown in the figure, you can protect desktop computers and other small appliances by restraining them in a variety of ways. Some methods, such as using hook-and-loop material (Velcro for example), require no tools. Others, which include using chain, cables, or elastic cord ("bungee" cords for example), will usually require simple hand tools.

Tips

Keep these points in mind when you restrain desktop computers and appliances:

- Make sure that the desk or table the appliance sits on is not so light that it can be easily over-turned. If it is, and you can't move the appliance to another location, consider anchoring the desk or table to the floor or wall.

- You can anchor the ends of chains, cables, or elastic cords to either the wall or the surface of the desk, table, or counter using eye-hooks, rings, screws and washers, or other types of mounts.

- If you want to use a wall-anchored chain, cable, or cord, attach it to a closed eye-hook screwed into the wall or to a wall mount (such as a ring or plate) attached with screws. Make sure the eye-hook or screws are long enough to penetrate not just the wall but the studs behind it as well.

Estimated Cost

Restraining a single desktop computer or appliance with one of the methods described will cost you about $2 to $10, depending on the amount of hardware required. Using hook-and-loop material will be the cheapest method. Using chain or cable will be the most expensive method but may be necessary for heavy items.

Other Sources of Information

Seismic Retrofit Training for Building Contractors and Building Inspectors: Participant Handbook, FEMA, 1995

Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, FEMA-74, 1994

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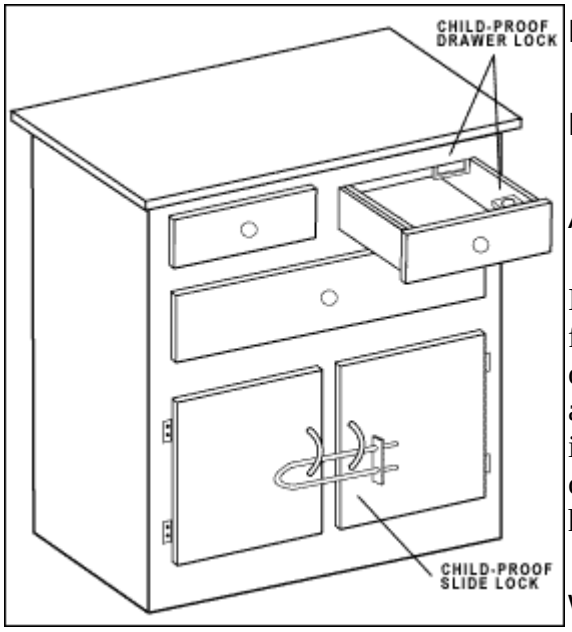

Protecting Your Property from Earthquakes

Drawers and Cabinet Doors

Are You at Risk?

If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earthquake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is installing latches on cabinet doors and drawers so that they will remain closed during an earthquake. This is something that many homeowners can probably do on their own.

Install Latches on Drawers and Cabinet Doors

During an earthquake, drawers and cabinet doors can open and the stored materials can spill out and damage floors and floor coverings. Objects that fall from overhead cabinets can injure you or members of your family.

One way to prevent the accidental opening of drawers and cabinet doors is to install latches such as barrel bolts, safety hasps, and child-proof locks. Most hardware and home supply stores stock a variety of latches. The figure shows two types child-proof locks, one for drawers and one for cabinet doors. Most types of permanent latches can be installed easily

and will not interfere with opening and closing of drawers and doors. The slide lock shown at right can be used on cabinets that do not need to be opened frequently; it is easily installed and removed.

Tips

Keep these points in mind when you install latches on drawers and cabinet doors:

- When possible, do not store heavy, breakable, or dangerous items (such as insecticides, solvents, and bleach) in overhead cabinets.
- Do not rely on magnetic or pinch-grip catches to hold cabinet doors closed, especially on overhead cabinets and any cabinets that contain heavy, breakable, or dangerous items.
- Install latches according to the manufacturer's directions. For example, use all of the hardware provided with the latch and do not substitute undersized screws or bolts for those provided.

Estimated Cost

The cost of adding latches will depend on the type you decide to buy and the number of drawers and cabinet doors you want to secure. Most latches will cost between $2 and $5. So, for example, If you do the work yourself, the cost of adding latches to all the cabinets and drawers in a medium-sized kitchen could range from about $60 to about $100. If you hire a contractor or handyman to install latches, you will have to pay for time as well as materials.

Other Sources of Information

Seismic Retrofit Training for Building Contractors and Building Inspectors: Participant Handbook, FEMA, 1995

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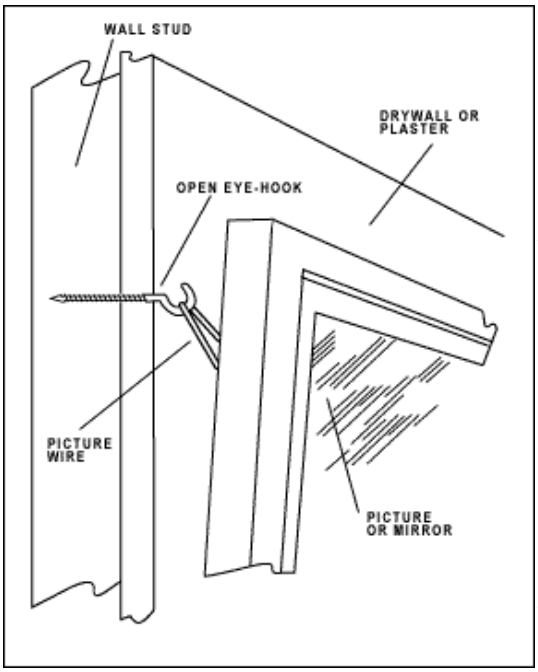

Protecting Your Property from Earthquakes

Framed Pictures and Mirrors

Are You At Risk?

If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earthquake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is stabilizing framed pictures and mirrors so that they will remain in place during an earthquake. This is something that many homeowners can probably do on their own.

Mount Framed Pictures and Mirrors Securely

During an earthquake, framed pictures and mirrors that are not securely attached to walls can easily fall. Large pictures and mirrors can cause injuries when they fall, and the broken glass that often results increases the potential for injury.

As shown in the figure, one way to mount framed pictures and mirrors securely is to use long-shanked, open eye-hooks instead of traditional picture hangers. The eye-hooks must be long enough to penetrate the wall stud as well as the drywall or plaster. Eye-hooks used in this way

are much less likely to pull out of the wall than picture hooks installed with nails that penetrate only the drywall or plaster. Also, an alternative to running wire across the back of the picture or mirror is to use closed eye-hooks securely screwed into the back of the frame.

Tips

Keep these points in mind when you hang framed pictures or mirrors:

- The number of eye hooks you need for a picture or mirror will depend on its size and weight. Large pictures and mirrors will be more stable when mounted on two hooks rather than one.
- Make sure that eye-hooks penetrate not just the wall but the studs behind it as well. Eye-hooks embedded only in drywall or plaster are likely to pull out. To be embedded deeply enough, eye-hooks should be at least 12 inches long.
- Regardless of whether you use picture wire or closed eye-hooks on the back of the picture or mirror, make sure the hooks, screws, or other types of mounting hardware are securely attached to the frame.
- If possible, don't hang large pictures or mirrors in places where they are more likely to fall on someone, such as over beds, chairs, or couches.

Estimated Cost

The cost of mounting a picture or mirror with eye-hooks will depend on its size and weight. In general, for a large picture or mirror that requires two eye-hooks, you can expect the cost to be approximately $3 to $5. This amount covers only the hardware you will have to buy, not any tools you use or the value of your time. If you hire a contractor or handyman to do the work, you will have to pay for time as well as materials.

Other Sources of Information

Seismic Retrofit Training for Building Contractors and Building Inspectors: Participant Handbook, FEMA, 1995
Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, FEMA-74, 1994
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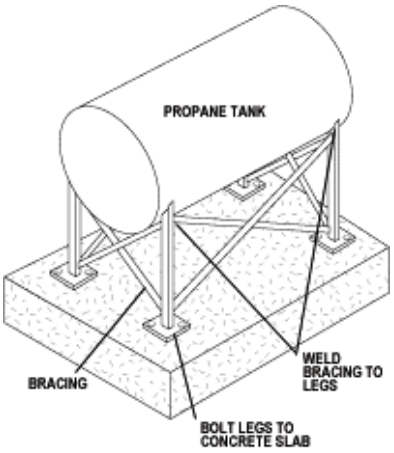

Protecting Your Property from Earthquakes

Propane Tanks and Gas Cylinders

Are You at Risk?

If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earth-quake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. Examples of earthquake protection are anchoring and bracing propane tanks and com-pressed gas cylinders. These are things that skilled homeowners can probably do on their own.

Anchor and Brace Propane Tanks and Gas Cylinders

During earthquakes, propane tanks can break free of their supporting legs. When a tank falls, there is always a danger of a fire or an explosion. Even when a tank remains on its legs, its supply line can be ruptured. Escaping gas can then cause a fire. Similar problems can occur with smaller, compressed gas cylinders, which are often stored inside a house or garage.

One way to prevent damage to propane tanks and compressed gas cylinders is to anchor and brace them securely. The figure shows how the legs of a propane tank can be braced and anchored. Using a flexible connection on the supply line will help reduce the likelihood of a leak. Compressed gas cylinders, because they have to be periodically replaced, cannot be permanently anchored. But you can use chains to attach them to a wall so that they will remain upright.

Tips

Keep these points in mind when you anchor and brace propane tanks or compressed gas cylinders:

Before you alter your propane tank in any way, make sure that the tank is your property and not rented from the propane supplier. Before welding new bracing to the tank legs, you must remove the gas from the tank. You should also check with your propane supplier to find out whether additional precautions are necessary.

Clear the area around the propane tank to ensure that there are no tall or heavy objects that could fall on the tank or rupture the supply line.

Keep a wrench near the shutoff valve and make sure the members of your family know how to turn off the supply line if they smell a gas leak. On larger tanks, such as farm tanks, consider installing a seismic shutoff valve that will automatically turn off the gas during an earthquake.

Provide a flexible connection between the propane tank and the supply line and where the supply line enters the house. But keep in mind that adding a flexible connection to a propane tank line should be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.

To attach a compressed gas cylinder to a wall, use two lengths of chain around the cylinder -- one just below the top of the cylinder and one just above the bottom. The chains should be attached to eye hooks that are screwed into the wall. In wood-frame walls, the eye hooks must be long enough to penetrate not just the wall but the studs behind it as well. In concrete or masonry block walls, the eye hooks should be installed with expansion anchors or molly bolts.

Estimated Cost

Bracing and anchoring a propane tank will cost about $250. Having flexible connections installed on the tank and at the house will cost about $75. Attaching one gas cylinder to the wall will cost about $50.

Other Sources of Information

Seismic Retrofit Training for Building Contractors and Building Inspectors: Participant Handbook, FEMA, 1995

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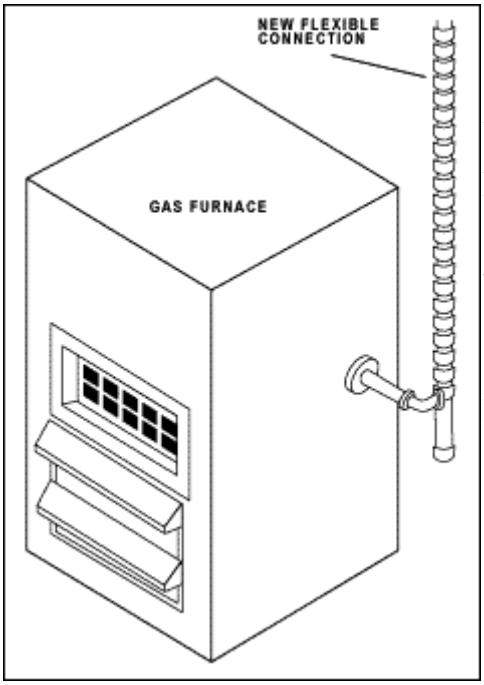
Protecting Your Property from Earthquakes

Gas and Water Lines

Are You At Risk?



If you aren't sure whether your house is at risk from earthquakes, check with your local building official, city engineer, or planning and zoning administrator. They can tell you whether you are in an earthquake hazard area. Also, they usually can tell you how to protect yourself and your house and property from earthquakes.

What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is installing flexible connections on gas and water lines. This is something that only a licensed contractor should do.

Use Flexible Connections on Gas and Water Lines

Because most gas and water lines are rigid, they can be torn from their connection points during an earthquake. The results could include not only serious damage to your house but also injury to you and members of your family. A broken gas line is especially serious because of the potential for a fire or even an explosion.

One way to prevent broken gas and water lines is to have flexible connection pipes installed between appliances and their supply lines. The figure shows a flexible connection installed on a gas furnace. The same method can be used for other appliances, such as a hot water heater, clothes dryer, or stove. A licensed contractor can usually do this for you easily.

Tips

Keep these points in mind when you have flexible connections installed:

- Changes to the gas lines and plumbing in your house must be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.

- A flexible connection will help protect against a small amount of movement but is not designed to function when the appliance it is connected to moves extensively or falls. So you should also consider anchoring the appliance to the floor or wall.

Estimated Cost

Having a flexible connection installed on a furnace or other large appliance will cost you about $75.

Other Sources of Information

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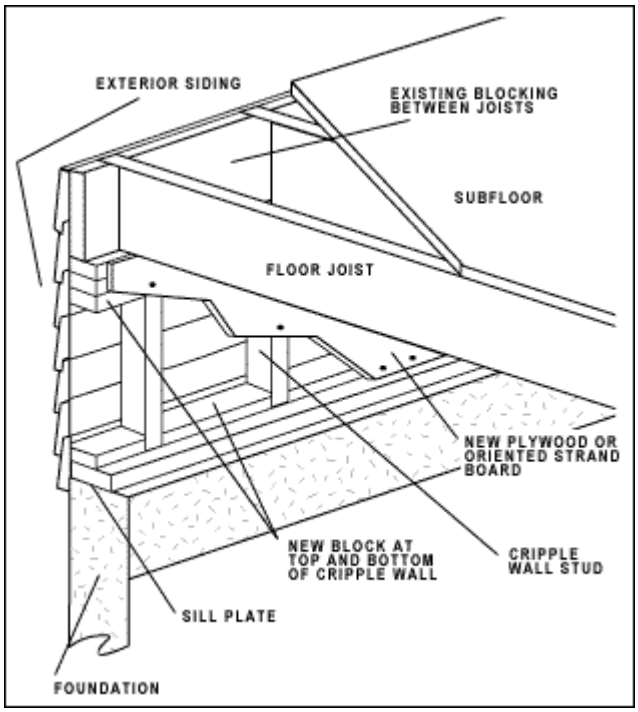
Protecting Your Property from Earthquakes

Brace Cripple Walls



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What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection, for a house built on a cripple wall foundation, is bracing the cripple wall to increase structural stability. This is something that skilled homeowners can probably do on their own, provided they obtain any necessary permits.

Brace Cripple Walls

Some houses are built on cripple walls. As shown in the figure, a cripple wall is a short

wall that rests on the foundation and supports the floor and exterior walls. If the cripple wall is not braced, it can shift during an earthquake. When this occurs, there is a greater likelihood that your house will be severely damaged and that you and members of your family will be injured.

If your house is built on cripple walls, one way to increase its stability and reduce earthquake damage is to brace the cripple walls. In this method, horizontal blocking that consists of 2" by 4" boards is added between the vertical studs at the top and bottom of the cripple wall and, if necessary, at other locations between the studs. New vertical studs can also be added if necessary. Plywood or oriented strand board is then nailed to the interior face of the cripple wall. Also, nails are added through the existing blocking between floor joists to ensure that the floor is securely attached to the cripple wall.

Tips

Keep these points in mind when you brace cripple walls:

- Check with your local building officials to see whether you need a permit to do this work.
- Before adding any bracing, check to see whether the sill plate below the cripple wall is bolted or otherwise anchored to the top of the foundation. If it is not, you should consider having bolts or anchors added. Any anchoring of the sill plate should be done before you add bracing. For more information, refer to the separate earthquake protection fact sheet titled Bolt Sill Plates to Foundation.

Estimated Cost

Bracing a 2-foot-high cripple wall will cost you about $1.50 per linear foot of wall. For example, a house measuring 60 feet by 30 feet will have a perimeter of 180 feet. So the cost for that house would be about $270. This figure covers only the materials you will have to buy and excludes the cost of any tools you use, building permit fees, and the value of your time. This figure also excludes the cost of having a contractor anchor your sill plates. Also, bracing higher cripple walls may require more lumber and therefore may be more expensive.

Other Sources of Information

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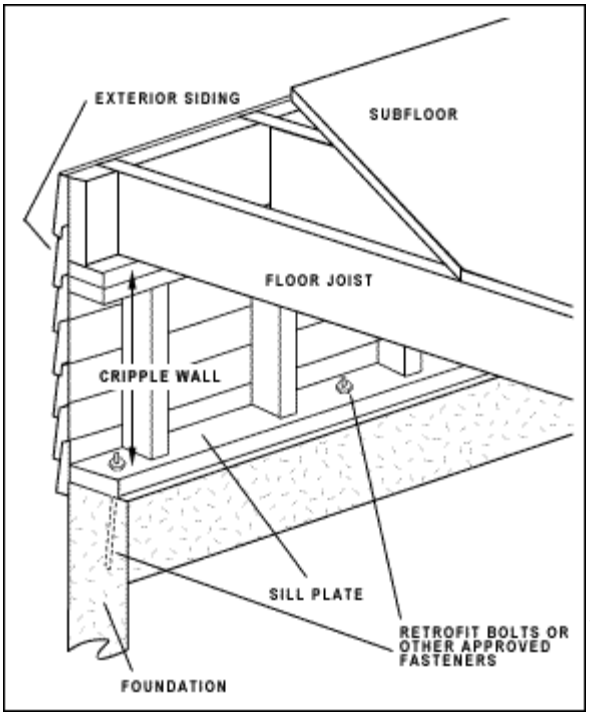
Protecting Your Property from Earthquakes

Bolt Sill Plates to Foundation

Are You At Risk?



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What You Can Do

Earthquake protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. One example of earthquake protection is bolting the sill plates of your house to its foundation to increase structural stability. This is something that only a licensed contractor should do.

Bolt Sill Plates to Foundation

As shown in the figure, the sill plate of a house rests directly on top of the foundation. (This figure shows the sill plate for a house built on a cripple wall and crawl space foundation, a type

of construction that is especially susceptible to earthquake damage.) If the sill plate is not securely anchored, an earthquake can cause it to shift on the foundation. When this occurs, there is a greater potential for severe damage as well as injury to you and members of your family.

One way to increase the stability of your house and reduce earthquake damage is to have the sill plate bolted or otherwise anchored to the foundation. In the method shown in the figure, bolts long enough to pass through the sill plate and penetrate several inches into the foundation are installed every few feet along the base of the exterior walls. This method is not limited to cripple wall construction; it can also be used for a house built on a basement or slab-on-grade foundation or on another type of crawl space foundation.

Tips

Keep these points in mind when you have the sill plates bolted to the foundation:

- Modifications to the foundation of your house must be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.
- Bolts are usually installed no more than 6 feet apart. The work involved is likely to be extensive and may require that portions of the walls or floor be cut away temporarily.
- Your contractor may be able to recommend an alternative anchoring method based on other approved fasteners or connectors that can be installed with fewer changes to your house and less work.
- If your house is built on cripple walls, you should consider bracing them after the sill plates are bolted. For more information, refer to the separate earthquake protection fact sheet titled Brace Cripple Walls.

Estimated Cost

Having a contractor bolt the sill plates to the foundation will cost you about $50 to $75 per bolt, depending on the type of foundation you have. For example, a house measuring 60 feet by 30 feet, will have a perimeter of 180 feet and would therefore require a minimum of 30 bolts (if the bolts are placed no more than 6 feet apart). So the cost for that house would be about $1,500 to $2,250.

Other Sources of Information

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